

ECON 222A

Macroeconomic Theory I

The IS–LM/AD–AS Model

Lecture 17

Today's Lecture

- PS4 is due on April 1st.
- Lecture on April 1st taught by J-F (chapter 8).
- Class on April 8th only exercises.
- Tutorial?

Today's Lecture

- General Equilibrium in the IS-LM
- Attainment of General Equilibrium
- Working with the IS-LM model
- The AS-AD model

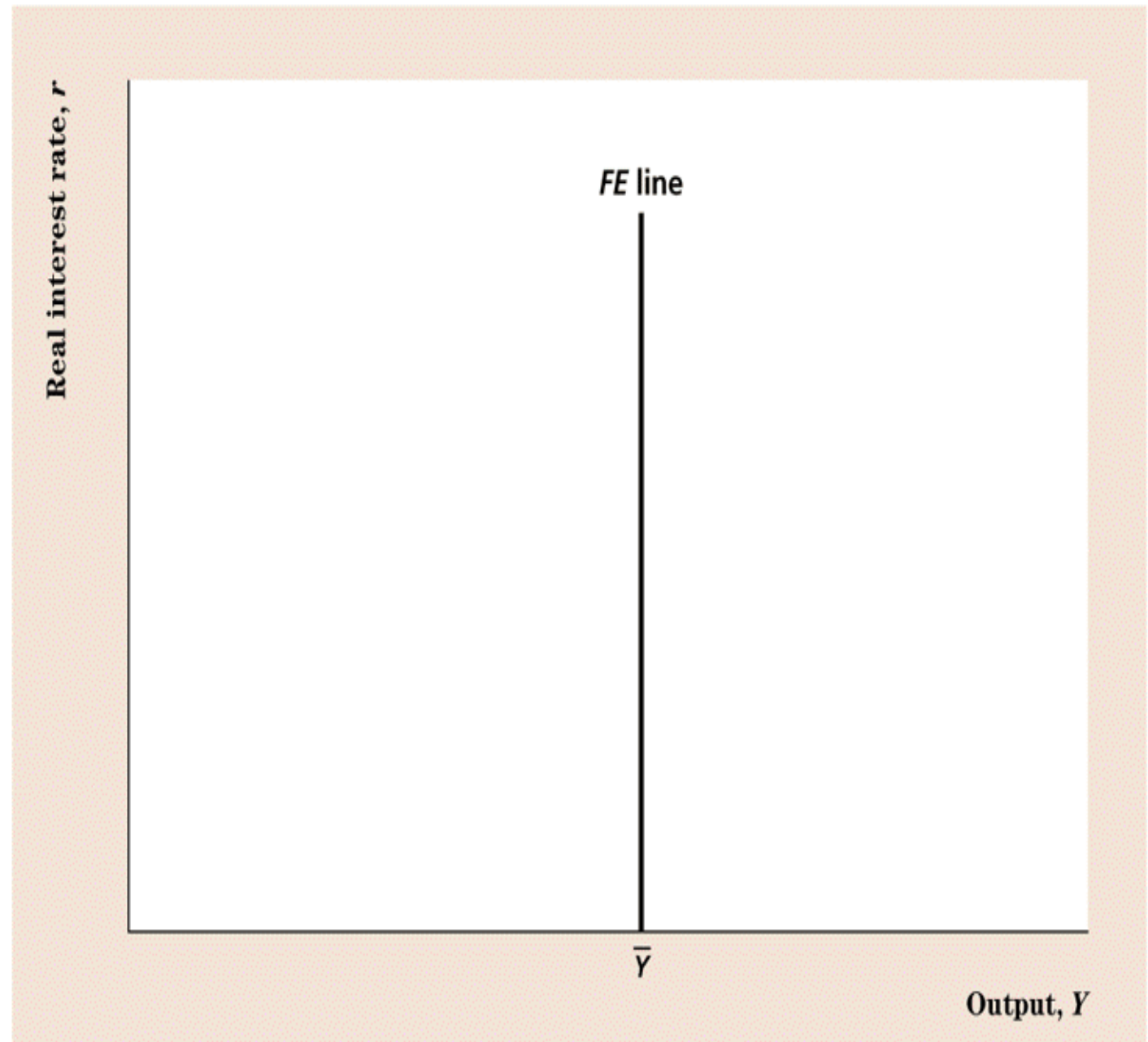
Labor Market Equilibrium (FE)

- FE: full employment curve
- Equilibrium level of N that is reached after wages and prices have fully adjusted so $N^S = N^D$ in the labor market
- Full employment output is \bar{Y} at this level
- It's a vertical line, in the (Y, r) diagram
- r has no role for full employment: only affects firms' long run investment decisions

FIGURE 9.1

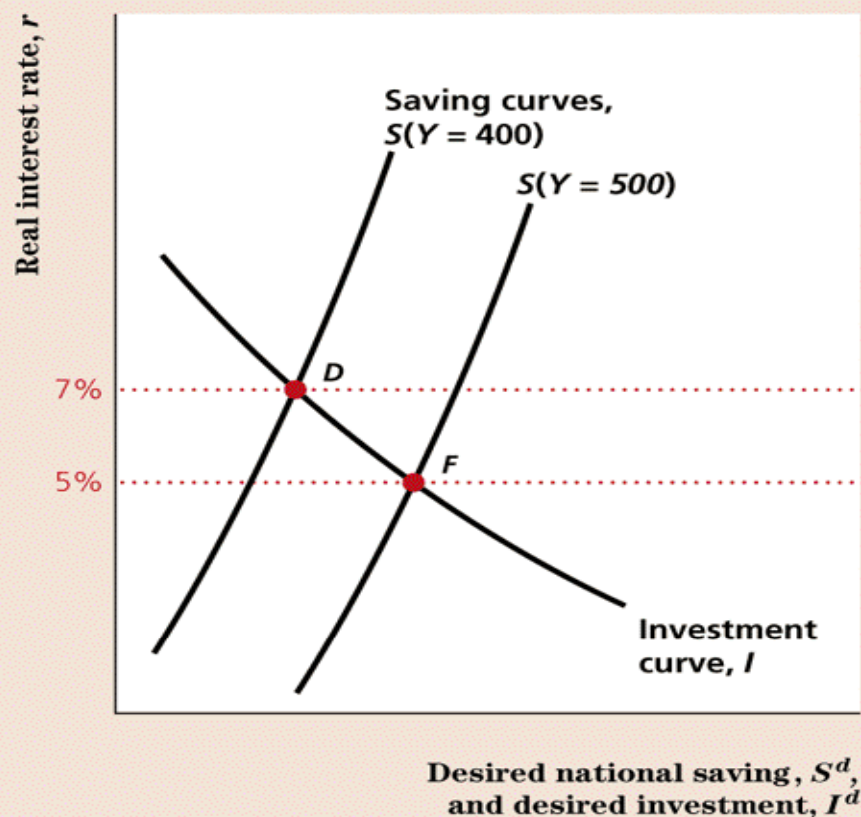
THE *FE* LINE

The full-employment (*FE*) line represents labour market equilibrium. When the labour market is in equilibrium, employment equals its full-employment level \bar{N} and output equals its full-employment level \bar{Y} , regardless of the value of the real interest rate. Thus, the *FE* line is vertical at $Y = \bar{Y}$.

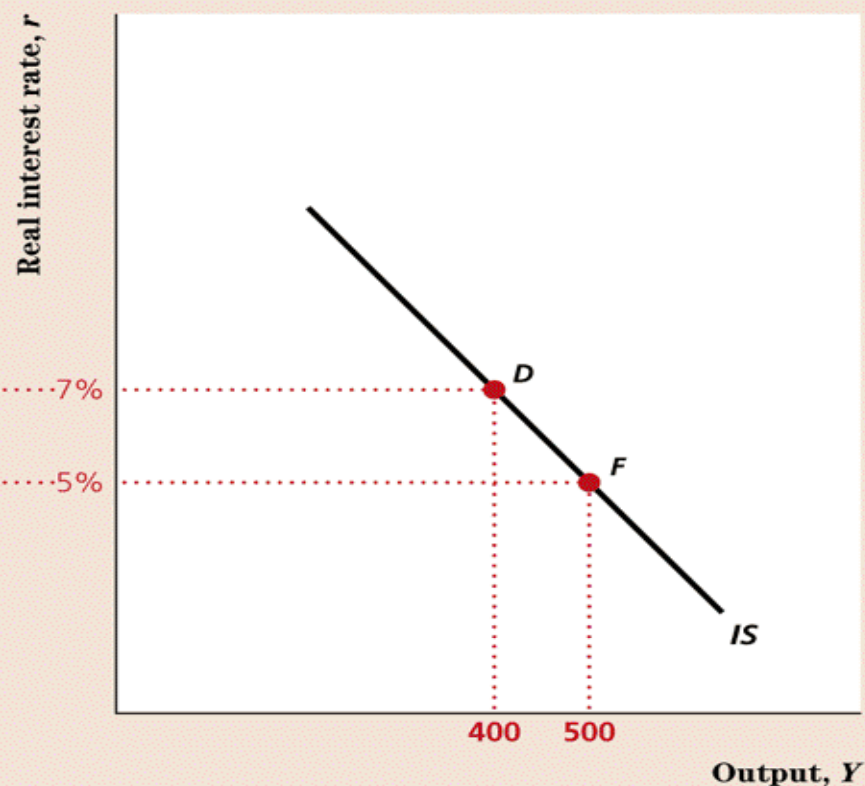


IS Curve (Goods Market Equilibrium)

- In a closed economy, r adjusts so that $I^d = S^d$
- Saving curve slopes up; Investment curve slopes down.
- IS curve: shows for any level of output, Y , the interest rate, r , which clears the goods market.
- At all points on the curve, $I = S$ (thus the name).
- IS curve slopes down because an increase in Y leads to an increase in S^d and r must fall to clear the goods market.



(a)



(b)

FIGURE 9.2

DERIVING THE IS CURVE

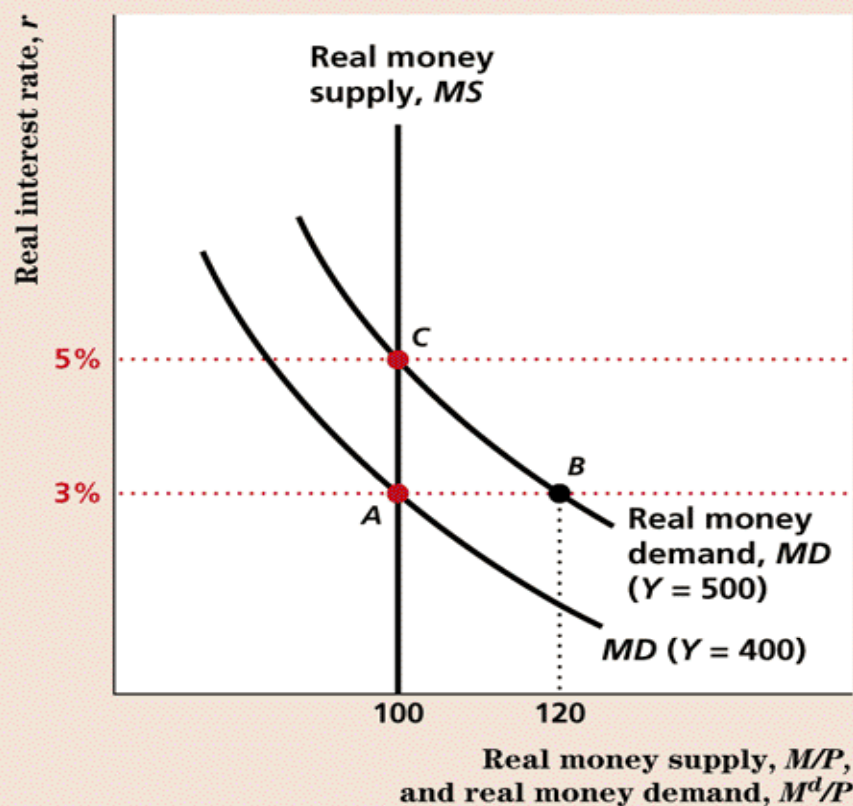
(a) The graph shows the goods market equilibrium for two different levels of output: 400 and 500 (the output corresponding to each saving curve is indicated in parentheses next to the curve). Higher levels of output (income) increase desired national saving and shift the saving curve to the right. When output is 400, the real interest rate that clears the goods market is 7% (point D). When output is 500, the market-clearing interest rate is 5% (point F).

(b) For each level of output the IS curve shows the corresponding real interest rate that clears the goods market. Thus, each point on the IS curve corresponds to an equilibrium point in the goods market. As in (a), when output is 400, the real interest rate that clears the goods market is 7% (point D); when output is 500, the market-clearing interest rate is 5% (point F). Because higher output raises saving and leads to a lower market-clearing interest rate, the IS curve slopes downward.

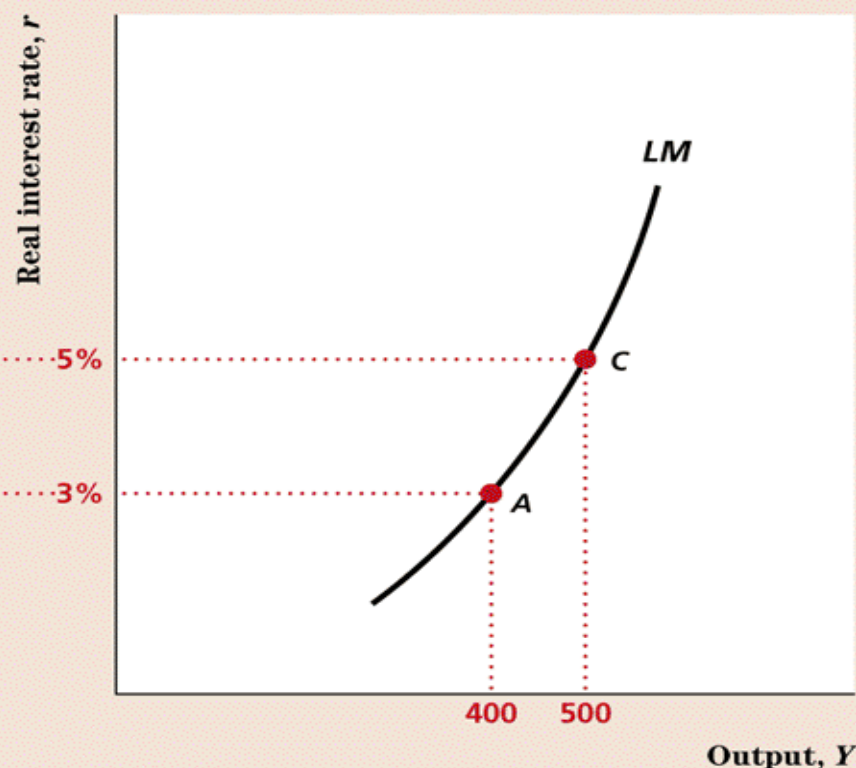
The LM Curve:

Asset Market Equilibrium

- The *LM* curve is a graphical representation of the relationship between output and the real interest rate that clears the asset market.
- The *LM* curve always slopes upward.
- At all points of the curve $M^D = M^S$.



(a)



(b)

FIGURE 9.4

DERIVING THE *LM* CURVE

(a) The curves show real money demand and real money supply. Real money supply is fixed at 100. When output is 400, the real money demand curve is $MD (Y = 400)$; the real interest rate that clears the asset market is 3% (point A). When output is 500, more money is demanded at the same real interest rate, so the real money demand curve shifts to the right to $MD (Y = 500)$. In this case, the real interest rate that clears the asset market is 5% (point C).

(b) The graph shows the corresponding *LM* curve. For each level of output, the *LM* curve shows the real interest rate that clears the asset market. Thus, when output is 400, the *LM* curve shows that the real interest rate that clears the goods market is 3% (point A). When output is 500, the *LM* curve shows a market-clearing real interest rate of 5% (point C). Because higher output raises money demand, and thus raises the real interest rate that clears the asset market, the *LM* curve slopes upward.

The LM Curve:

Asset Market Equilibrium

- The LM curve slopes upward because an increase in Y leads to an increase in M^D and r must rise to clear the asset market (or else there would be excess M^D)
- If Y increases, the demand for real money (M/P) increases, at any given r , and shifts M^D curve up.
- People try to sell assets for money.
- M^S is fixed by Bank of Canada
- Price of asset falls/ r increases
- Money demand decreases until $M^D = M^S$

General Equilibrium in the Complete *IS-LM* Model

- The general equilibrium of the economy:
 - the *FE* line along with the labor market is in equilibrium;
 - the *IS* curve, along with the goods market is in equilibrium;
 - the *LM* curve, along with the asset market is in equilibrium.
- Labor market, Goods market and Asset market are simultaneously in equilibrium

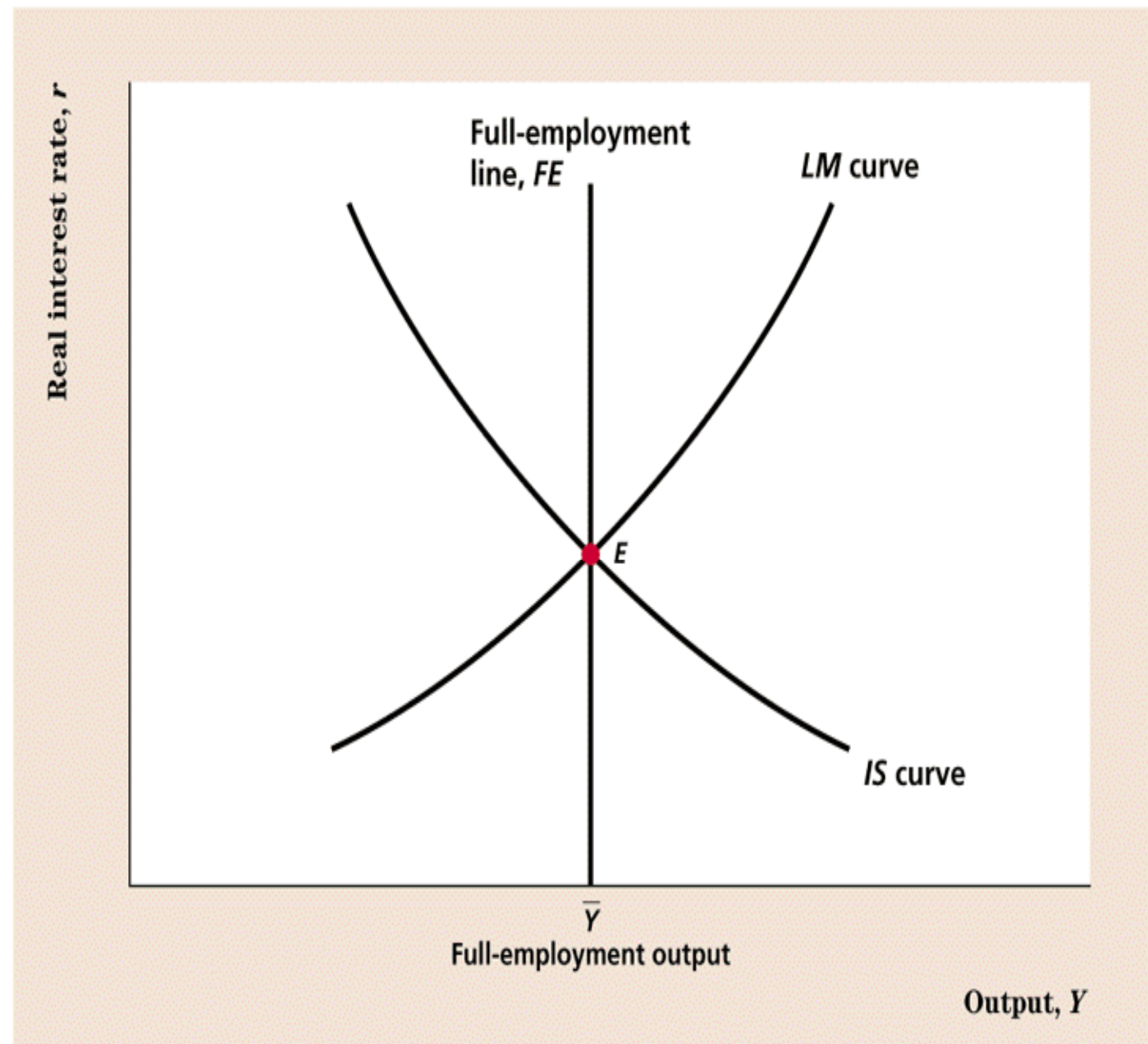
General Equilibrium in the Complete *IS-LM* Model

- The intersection of *FE*, *IS* and *LM* gives the equilibrium values of r and Y
- We are also able to find w, N, C, I, M, P
- In the short-run, the intersection of *IS* and *LM* is relevant
- In the long-run equilibrium, the intersection of *IS* and *FE* is relevant
- When not in GE, price adjustment shifts *LM* around to re-establish new GE.

FIGURE 9.7

GENERAL EQUILIBRIUM IN THE *IS-LM* MODEL

The economy is in general equilibrium when quantities supplied equal quantities demanded in every market. The general equilibrium point, E , lies on the IS curve, the LM curve, and the FE line. Thus, at E , and only at E , the goods market, the asset market, and the labour market are simultaneously in equilibrium.



General Equilibrium in the *IS-LM*

- Labor Market, Goods Market, and Asset Market in equilibrium at the same time
- Intersection of *FE*, *IS*, *LM*
- Keep in mind:
 - Short Run Equilibrium: *IS-LM* intersect
 - Long Run Equilibrium: *IS-FE* intersect

Examples: Price Adjustment

- Example 1: Effects of a Monetary expansion
- Consider an increase in M^s
- LM curve shifts down (P does not change right away)
 - LM : Asset market responds right away
 - FE : Labor market, slow response
 - IS : Goods market response is in between; and we move along the IS curve in the Short Run
- So, Short Run equilibrium is where the IS-LM intersect

BUT there is MORE

- People rebalance portfolios: get rid of excess M balances by buying NM assets, NM prices rise, r decreases
- What does low r mean for C^d and I^d ?
 - lower r means higher C^d , I^d
 - firms are willing to temporarily produce more to meet this demand (key assumption)
- At the Short Run equilibrium point, the demand is met

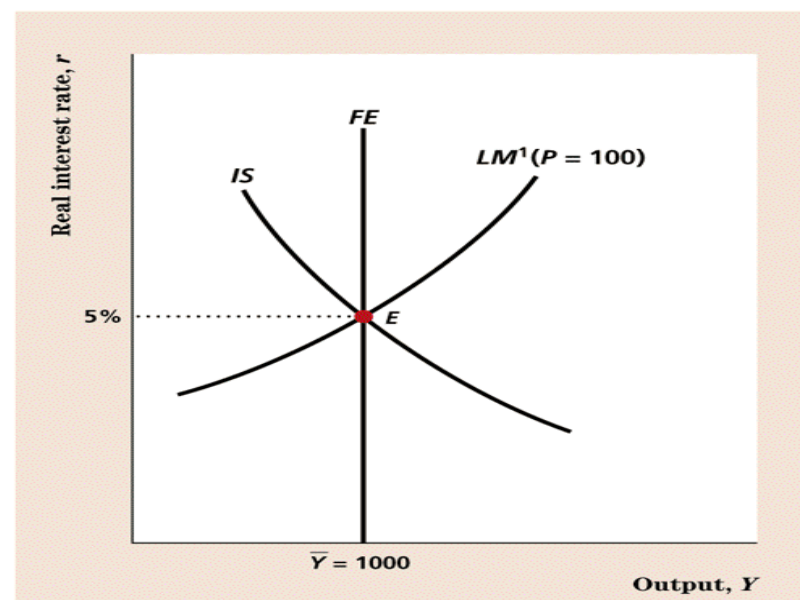
FIGURE 9.9

EFFECTS OF A MONETARY EXPANSION

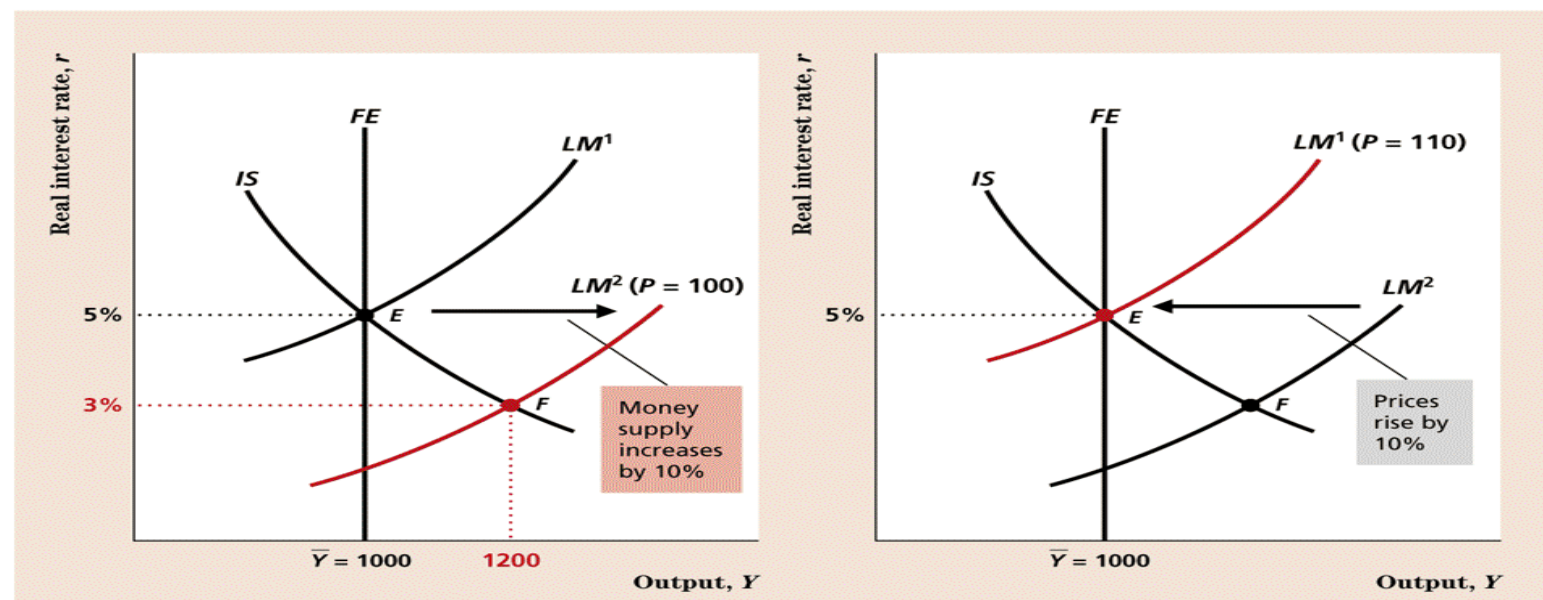
(a) The economy is in general equilibrium at point E . Output equals the full-employment level of 1000, the real interest rate is 5%, and the price level is 100.

(b) With the price level fixed, a 10% increase in the nominal money supply M raises the real money supply M/P and shifts the LM curve down from LM^1 to LM^2 . At point F , the intersection of the IS curve and the new LM curve, LM^2 , the real interest rate has fallen to 3%, which raises the aggregate demand for goods. If firms produce extra output to meet the increase in aggregate demand, output rises to 1200 (higher than full-employment output of 1000).

(c) Because aggregate demand exceeds full-employment output at point F , firms raise prices. A 10% rise in P , from 100 to 110, restores the real money supply to its original level and shifts the LM curve back to its original position at LM^1 . This returns the economy to point E , where output again is at its full-employment level of 1000, but the price level has risen 10% from 100 to 110.



(a)



(b)

(c)

and MORE...

- The economy is at the Short Run equilibrium, what's next?
- We have fixed P so far, which is not likely to happen for a long period of time
- Firms are producing more than full employment Y right now (e.g. through overtime, or reduction in inventories).
- This is not sustainable

Price Adjustment

- Firms start charging higher prices
- P starts rising, M/P is falling, and the LM curve shifts back
- This process continues until we get back to the FE point, and the GE is restored
- Classical and Keynesians debate on how long this price adjustment takes.

Comments

- M^s went up, and there was a Short Run effect, but NO real Long Run effect
- P eventually rose to restore the Long Run equilibrium
- Real: $(r, Y, W/P)$ unchanged
- Nominal: (W, P) rose proportionally to the increase in M^s in the Long Run

Classics vs. Keynesians

- Still debating....
- How rapidly do we reach a new GE?
- What are the effects of monetary policy?
 - Classics: rapid price adjustment, P rises fast, so no persistent real effect
 - Keynesians: slow price adjustment, Y rises and P slow to adjust, then there are persistent real effects

Monetary Neutrality

- What did the change in M^s actually do for the economy?
- Y, r, N ended up being unchanged
- We say when the real variables don't change with a change in the M^s that money is neutral
- Note: our framework can handle growth in output or money/prices, and we can interpret all short run deviations from their long-run trend growth

Examples: Price Adjustment

- Example 2: Temporary Adverse Supply Shock (decrease in A)
- This reduces MPN , ND falls
- A decrease in employment N and real wage w follow
- The change in A is temporary, or the NS curve is unaffected (assume no wealth or future wage effects)
- Y falls, FE shifts left

Effects

- *IS*: There are no impacts on savings and investment, move along curve, there is no shift of the curve (temporary, no change in wealth; or expected Y^f ; MPK^f)
- *LM*: nothing at first, but recall *LM* shifts to restore *GE*, there is an increase in P , real M^S shifts left and *LM* curve shifts up
- Overall effects of temporary adverse supply shock:
 - A decrease in w , N , Y , C , I
 - An increase in r , P , π

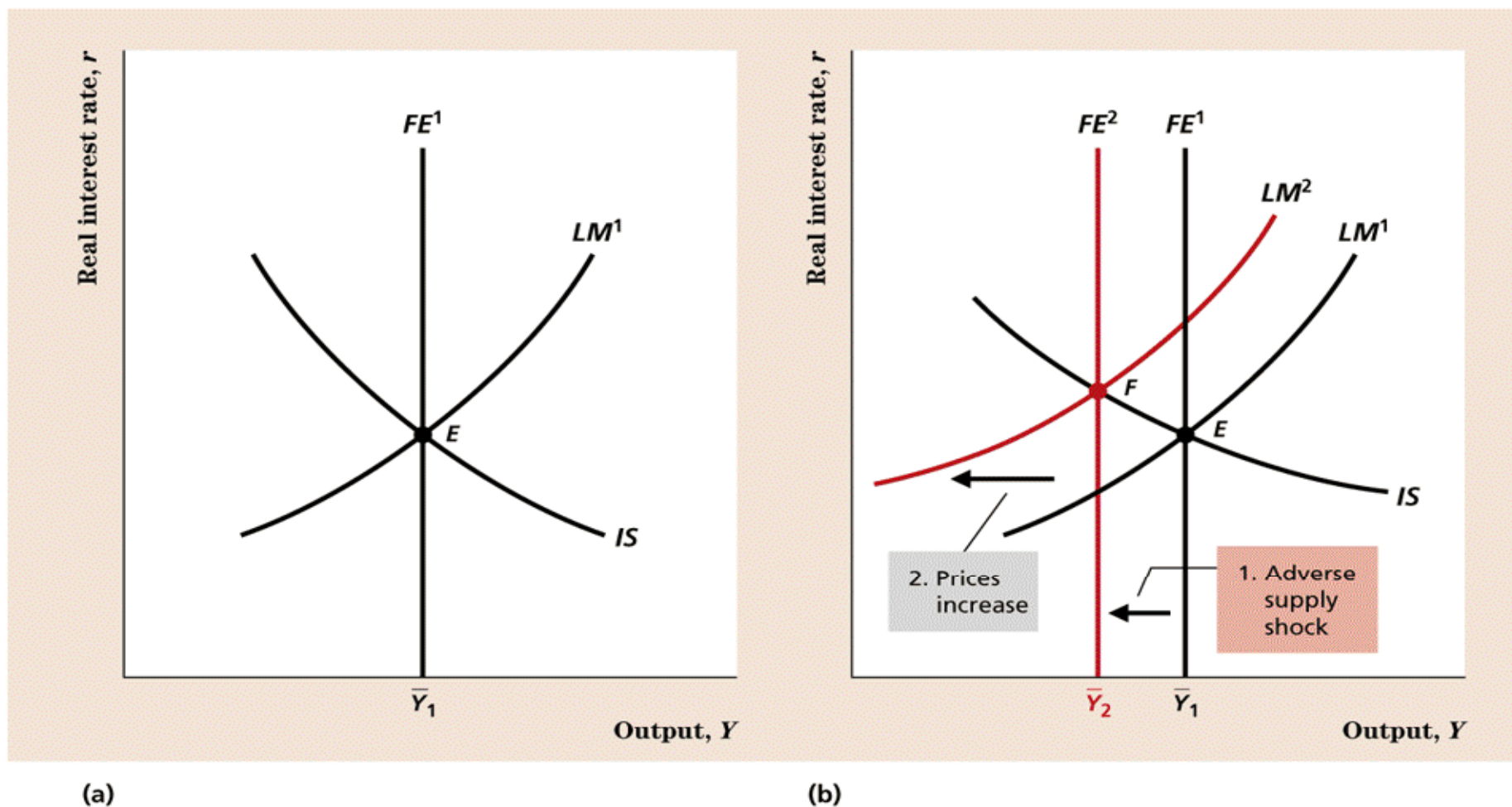


FIGURE 9.8

EFFECTS OF A TEMPORARY ADVERSE SUPPLY SHOCK

(a) Initially, the economy is in general equilibrium at point E , with output at its full-employment level \bar{Y}_1 .

(b) A temporary adverse supply shock reduces full-employment output from \bar{Y}_1 to \bar{Y}_2 and shifts the FE line to the left from FE^1 to FE^2 . The new general equilibrium is represented by point F , where FE^2

intersects the unchanged IS curve. The price level increases and shifts the LM curve up and to the left, from LM^1 to LM^2 , until it passes through F . At the new general equilibrium point, F , output is lower, the real interest rate is higher, and the price level is higher than at the original general equilibrium point, E .

AD-AS Model

- Now we use the *IS-LM* framework to get back the *AD-AS* model of chapter 8
- *IS-LM*: relates (Y, r)
 - more useful for saving, investment
- *AD-AS*: relates (Y, P)
 - more useful for inflation

AD Curve

- Intuitively: it's simple, it relates (aggregate) demand to the price level (downward slope)
- What happens if P goes up in $IS-LM$?
 - M/P falls, so LM shifts in
 - $IS-LM$ says new equilibrium is at a lower Y
 - So P rises, Y falls
 - If we plot these equilibrium points, we get the AD curve

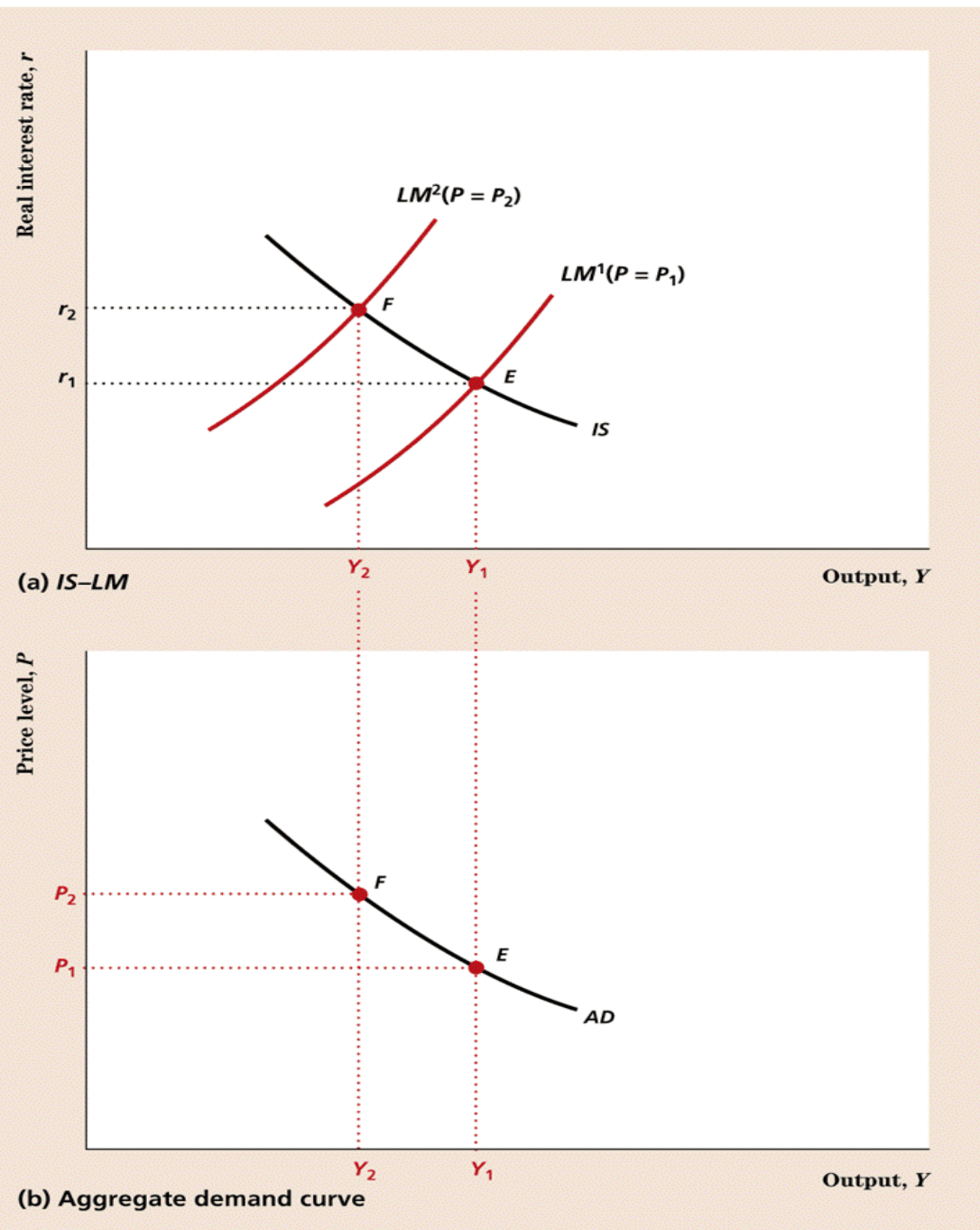
FIGURE 9.10

**DERIVATION OF THE
AGGREGATE DEMAND
CURVE**

For a given price level, the aggregate quantity of output demanded is determined where the *IS* and *LM* curves intersect. If the price level, P , is P_1 and the initial *LM* curve is LM^1 , the initial aggregate quantity of output demanded is Y_1 , corresponding to point *E* in both (a) and (b). To derive the aggregate demand curve, we examine what happens to the quantity of output demanded when the price level changes.

(a) An increase in the price level from P_1 to P_2 reduces the real money supply and shifts the *LM* curve up and to the left, from LM^1 to LM^2 . Therefore, the aggregate quantity of output demanded, represented by the intersection of the *IS* and *LM* curves, falls from Y_1 to Y_2 .

(b) The increase in the price level from P_1 to P_2 reduces the aggregate quantity of output demanded from Y_1 to Y_2 , so the aggregate demand curve slopes downward.



Shifting AD Curve

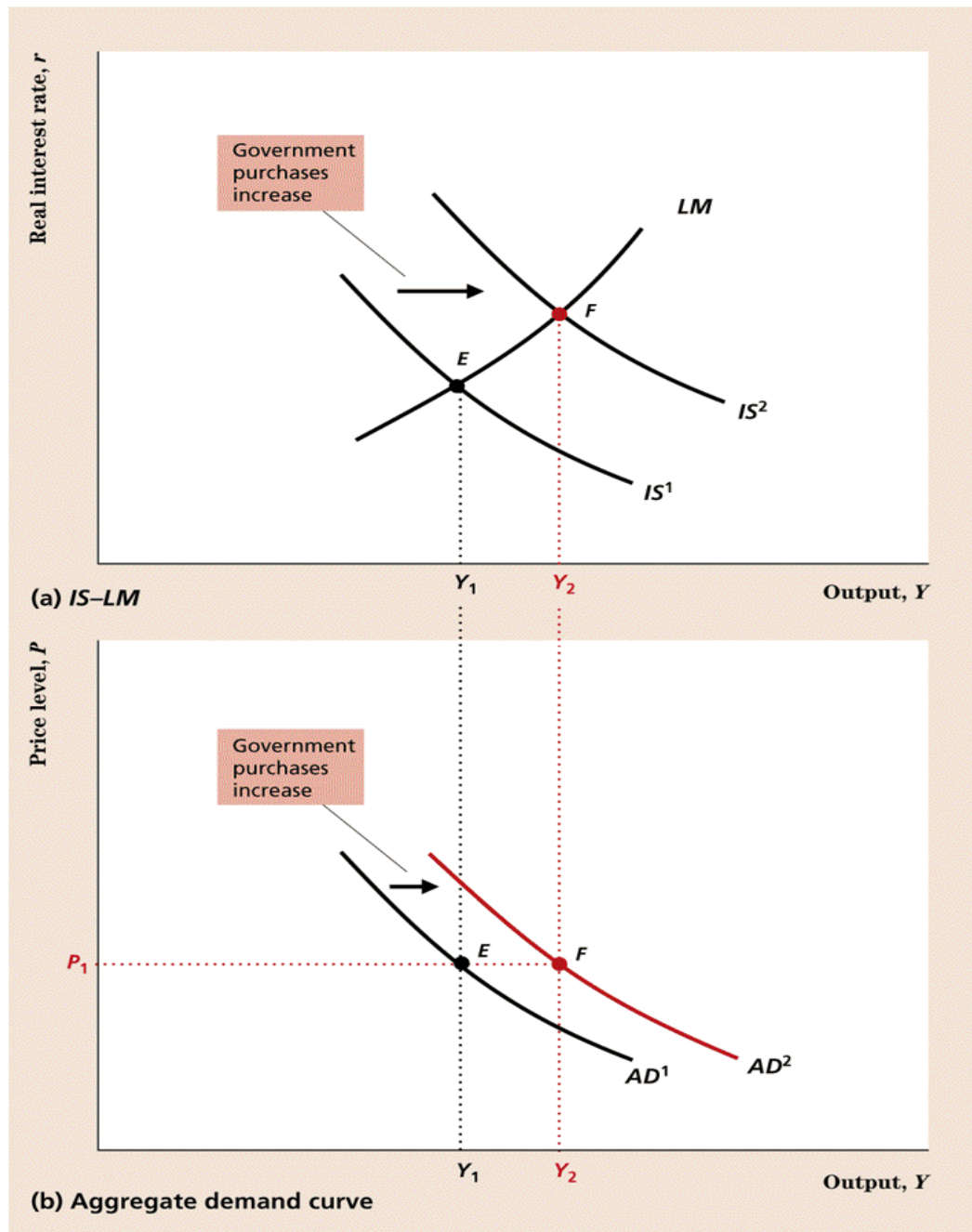
- AD from intersections of $IS-LM$ curves
- Holding P constant, anything else that shifts $IS-LM$ will shift AD
- Example: temporary rise in G
 - IS curve shifts out
 - AD shifts out

FIGURE 9.11

THE EFFECT OF AN INCREASE IN GOVERNMENT PURCHASES ON THE AGGREGATE DEMAND CURVE

(a) An increase in government purchases shifts the IS curve up and to the right, from IS^1 to IS^2 . At price level P_1 , the aggregate quantity of output demanded increases from Y_1 to Y_2 , as shown by the shift of the $IS-LM$ intersection from point E to point F .

(b) Because the aggregate quantity of output demanded rises at any price level, the AD curve shifts to the right. Points E and F in part (b) correspond to points E and F in part (a).



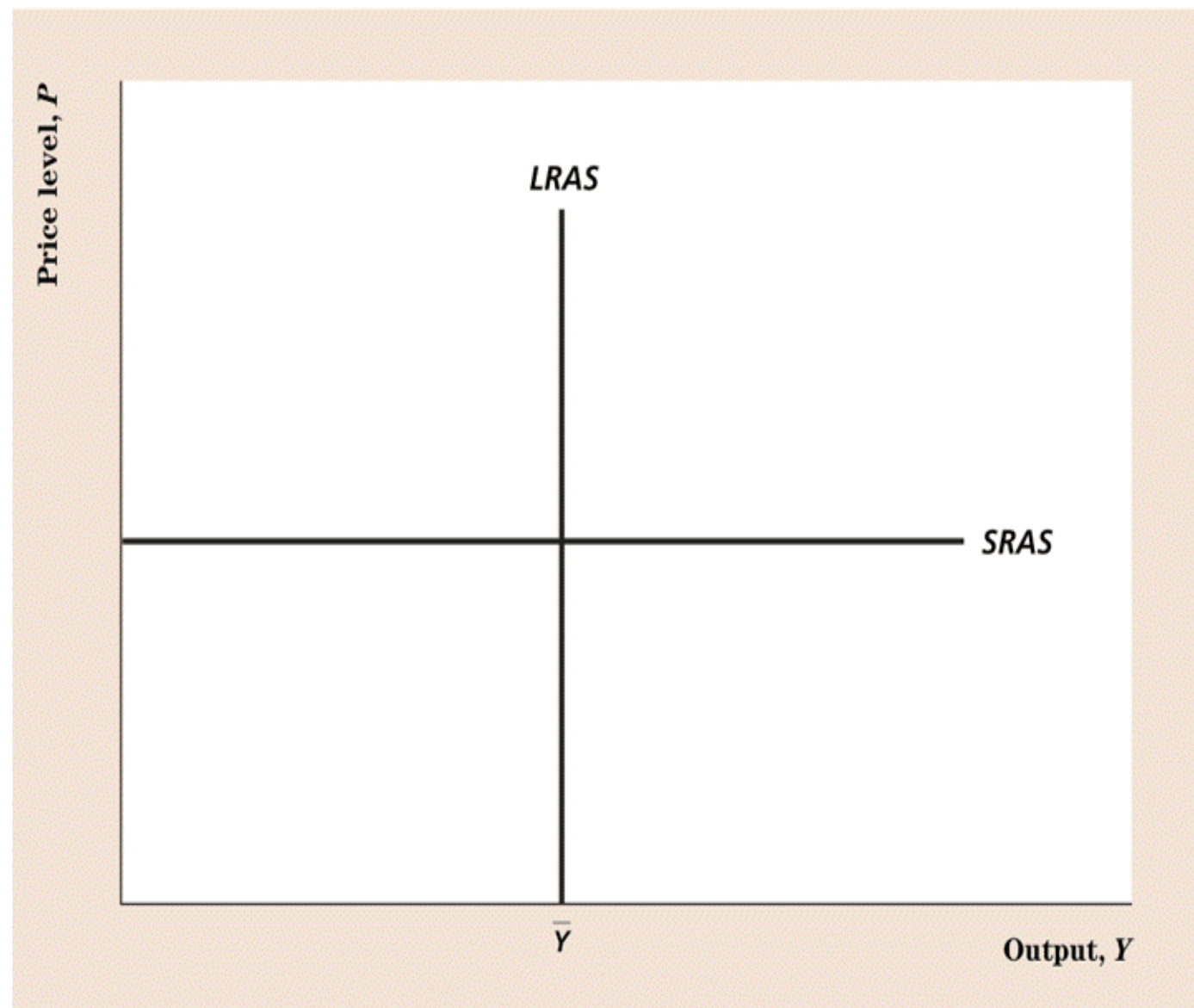
AS Curve

- It shows the relationship between the price level P and the aggregate output firms are willing to supply
- SRAS: price level fixed for any Y
- LRAS: labor market clears (FE) and we are at full employment \bar{Y}

FIGURE 9.12

THE SHORT-RUN AND LONG-RUN AGGREGATE SUPPLY CURVES

In the short run, firms supply the amount of output demanded at the fixed price, so the short-run aggregate supply (*SRAS*) curve is a horizontal line. In the long run, when the labour market clears, firms supply the full-employment level of output, \bar{Y} , regardless of the price level. Thus, the long-run aggregate supply (*LRAS*) curve is a vertical line at $Y = \bar{Y}$.



Shifting the AS curves

- LRAS shifts
 - anything that affects FE output (or shifts the FE curve)
- SRAS shifts
 - if firms change their prices in the Short Run then it shifts
 - shifts up if costs rise in the Short Run

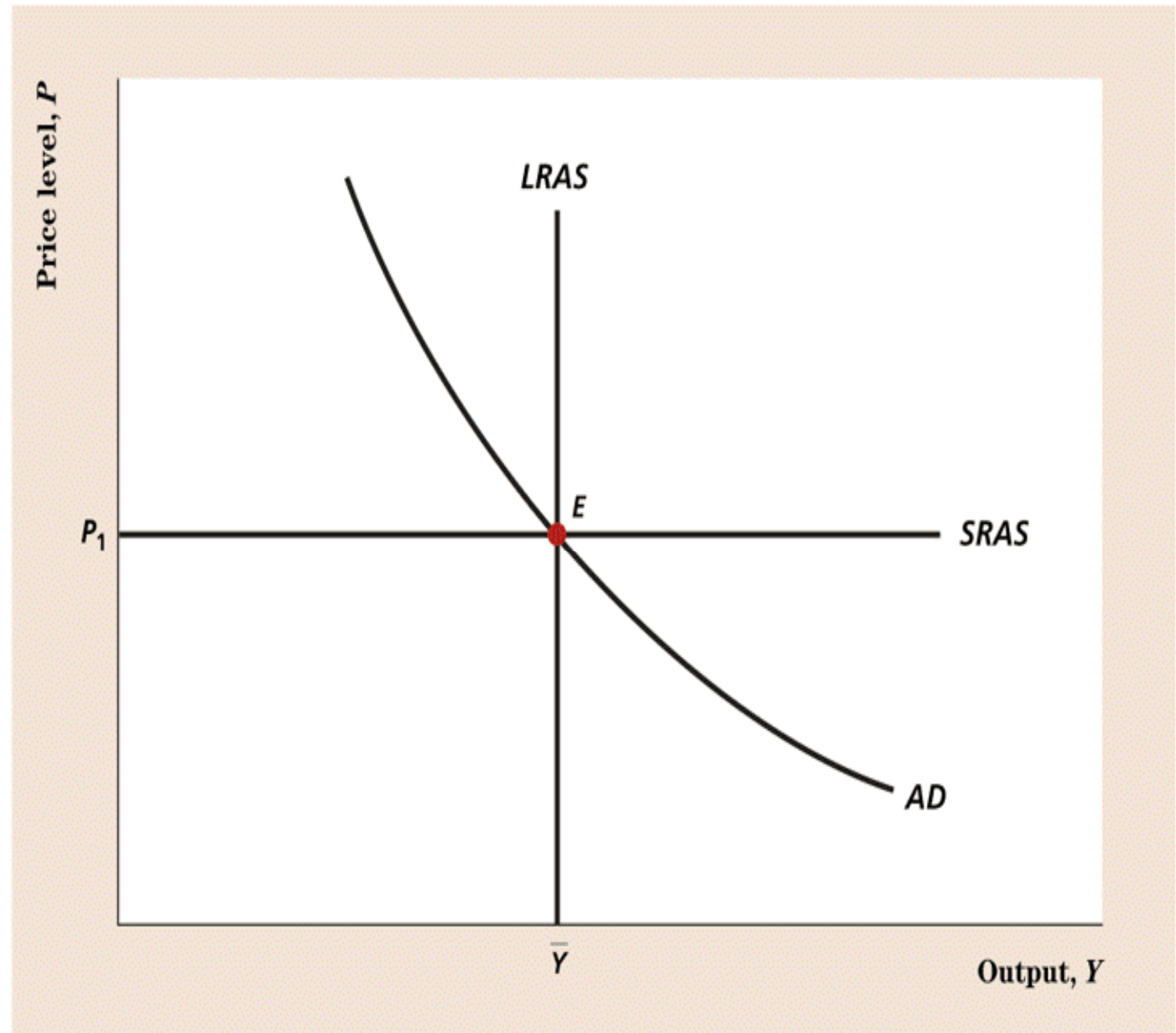
AD-AS Equilibrium

- LRAS – AD intersection is the *GE* from before

FIGURE 9.13

EQUILIBRIUM IN THE *AD-AS* MODEL

Short-run equilibrium is represented by the intersection of the *AD* and *SRAS* curves at point *E*. At short-run equilibrium, prices are fixed and firms meet demand at those prices. Long-run equilibrium, which occurs after prices have fully adjusted, is represented by the intersection of the *AD* and *LRAS* curves, also at point *E*. Long-run equilibrium is the same as general equilibrium because in long-run equilibrium all markets clear.



Money Neutrality

- Suppose M rises (three figures)
 - $M^s - M^d$
 - $IS - LM$
 - $AS - AD$
- Short Run: Y rises above FE level
- Long Run: SRAS shifts up as prices rise
- So increase in M raises P , while Y unchanged

FIGURE 9.14

**MONETARY NEUTRALITY IN
THE *AD-AS* FRAMEWORK**

If we start from general equilibrium at point *E*, a 10% increase in the nominal money supply shifts the *AD* curve up by 10% at each level of output, from *AD*¹ to *AD*². The *AD* curve shifts up by 10% because at any given level of output, a 10% increase in the price level is needed to keep the real money supply, and, thus, the aggregate quantity of output demanded, unchanged. In the new short-run equilibrium at point *F*, the price level is unchanged, and output is higher than its full-employment level. In the new long-run equilibrium at point *H*, output is unchanged at \bar{Y} , and the price level P_2 is 10% higher than the initial price level P_1 . Thus, money is neutral in the long run.

